



Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

BDE PROCEDURE MEMORANDUM

NUMBER: 47-05

BMPR POLICY MEMORANDUM

NUMBER: 05-06

SUBJECT: Guidelines for Pavement Preservation

DATE: September 19, 2005

Background

In Fiscal Year 2005, the department began an effort to investigate the use of pavement preservation techniques such as Bituminous Surface Treatment, Cape Seal, Microsurfacing and Slurry Seal in an attempt to more cost-effectively preserve the condition of existing pavements.

These techniques should not to be confused with the pavement rehabilitation method known as the "Pavement Preservation Program" (3P) as outlined in Chapter 53-4 of the BDE Manual. Pavement preservation, in the context of this memorandum, is a set of preventive practices involving the timely application of carefully selected surface treatments to maintain or extend a pavement's service life. These treatments are generally applied at higher Condition Rating Survey (CRS) values than 3P or Surface Maintenance At the Right Time (SMART) rehabilitation methods, as outlined in Chapter 53-4 of the BDE Manual.

The purpose of this memorandum is to transmit guidelines to aid in the selection of projects on which pavement preservation methods might be appropriate.

Applicability

The procedures in this memorandum are applicable to projects which may be eligible for the use of pavement preservation methods.

Procedures

"Pavement Preservation Guidelines for Illinois State Highways", dated March 7, 2005, is a set of guidelines for the selection of projects on which pavement preservation methods may be considered.

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Attachment

Pavement Preservation for Illinois State Highways

March 7, 2005

Background:

There has been a long standing mind set that marked state highways should have one of two paving material surfaces, Bituminous or Concrete. Use of these materials results in long pavement life, however, the future rehabilitation cost to maintain these surfaces can be rather high, especially for low volume roads. After the original pavement life is exhausted, typically a bituminous overlay is placed resulting in a need for subsequent overlays every 15 years, more or less. For lower volume roads, funding rehabilitation is typically a low priority and is deferred as long as possible. The result is that once a project is undertaken it is more costly and most likely will not provide the length of service desired.

Pavement Preservation is desired where rehabilitation will be done earlier, before the pavement is highly distressed, by use of less intensive treatments. This strategy will “prevent” the pavement from having additional deterioration and “maintain” or improve the surface condition. Below are recommended activities and general criteria for a preventive maintenance program. These guidelines are conservative and are subject to change as more experience is gained with these rehabilitation methods.

Generally Recommended Criteria and Preservation Activity

ADT	CRS	Age, Yrs	Pavement Action
2000 and Under	6.5 to 7.5	5 to 7	Slurry Seal (45 MPH or less), Micro-surfacing, Bituminous Surface Treatment (Preventive Maintenance)
3000 and Under	Below 6.5	Over 15	Cape Seal (If CRS above 5.0)
2000 and Under	5.0 to 6.5	10 to 15	Half-SMART (Nominal ¾-inch overlay) plus Bituminous Surface Treatment (Preventive Maintenance)

When selecting a project, the entire pavement management section must be considered for determining project limits. Do not select a portion of a management section if the remainder of the section will control the next rehabilitation activity. Treatments on partial management sections that will bring a short segment up to the same performance of the surrounding pavement are appropriate.

As before, each district should choose one or more projects to address preservation needs within the allowed budget. The target amount to be programmed for project(s) is ~\$300,000 per district. Projects may be combined into one contract if it would be more reasonable for construction purposes. Funding can be from either the regular program or Contract Maintenance. Although SMART overlays are considered pavement preservation, it shall not be used as a treatment option for preventive maintenance projects. The other surface treatments should be used in order to gain experience with the construction processes and performance.

Definitions:

Bituminous Surface Treatment (Preventive Maintenance) – This treatment is nearly identical to a traditional A-1 treatment found in Section 403 of the Standard Specifications, but with Polymer Modified Emulsified Asphalt. Aggregates shall meet the friction policy. The construction is very

similar also, but restricted to more modern equipment and techniques. Additional restrictions are placed on allowable weather conditions and time of year.

Cape Seal – This treatment is basically a combination of a Bituminous Surface Treatment (Preventive Maintenance) and Micro-Surfacing. The Bituminous Surface Treatment (Preventive Maintenance) is applied first and Micro-Surfacing is applied second.

Half-SMART overlay – This treatment consists of a nominal ¾ inch HMA overlay with a Bituminous Surface Treatment (Preventive Maintenance) as a top lift. The overlay shall be placed according to Section 406 of the Standard Specifications.

Micro-Surfacing – Similar to a slurry seal, micro-surfacing is a mixture of well graded aggregate, latex modified emulsified asphalt, filler, additives, and water. This special provision is nearly identical to the traditional micro-surfacing treatment found in Section 448 of the Standard Specifications; however, more emphasis is placed on proper mix design and material development to insure better performance. The construction is very similar also, but restricted to more modern equipment and techniques. Specialized design techniques are used to allow quick opening to traffic of lifts up to 1.5 inches in thickness. Typical micro-surfacing ranges in depth from 1/4 to 1/2 inch for each pass.

Slurry Seal – This treatment is a mixture of dense graded aggregate, emulsified asphalt, filler, additives, and water. The mixture is applied as a surface treatment. Typically applied in a thickness of 1/4 to 1/2 inch.

Limitations:

Raised Pavement Markers (RPMs) – The Department has adopted a policy of installing reflective markers in the centerline of highways with an ADT of 2500 and above. This policy limits the application of typical preventive maintenance treatments to those roadways where reflectors will not be encountered. Before selecting a section for treatment, a review should be made as markers are often placed on routes with ADT values below 2500.

When selecting projects, the District Planning CRS unit should be contacted to review video logs to determine if markers will be an issue for candidate sections. For bituminous surface treatment applications, the lens of the marker can be removed and tape placed over the marker. After the surface treatment operation, the tape can be removed and a new lens can be installed. As an alternative, the markers can be removed and reinstalled with new reflectors. The hole from removal of the markers should be repaired prior to the new treatment. To reinstall pavement markers after a seal coat or micro-surfacing, a waiting period of 7 days with good drying weather should be allowed for the new surface to fully cure.

The use of slurry seals, micro-surfacing, and cape seals may not lend themselves to leaving the RPMs in place. The thickness of the treatment should be evaluated to determine if the RPMs can remain in place or need to be removed and repositioned in the new surface.

The use of SMART overlays in the range of 1.50 to 1.75 inches also allows the installation of the reflective markers.

Windshield Breakage – The use of seal coats can result in windshield breakage claims if proper traffic control and sweeping are not followed. New seal coat surfaces can be tender. Ideally, lead vehicles are used to make sure traffic does not damage the fresh surface and to keep claims down. Also, flaggers at crossing intersections may be needed. Finer aggregate gradations, as well as the use of lightweight aggregate, help to minimize claims as well.

Paint striping on new Micro-Surfacing and Bituminous Surface Treatment (Preventive Maintenance) – During the first few weeks after application of these surfaces, a small amount of the surface may dislodge or seat differently. The result is that a paint stripe placed immediately after placement will degrade slightly. The designer may wish to use a temporary stripe of water-based paint or foil-backed tape. Typically, after 7 days of good drying weather both bituminous surface treatment (preventive maintenance) and micro-surfacing treatments are ready for permanent striping.

Aggregate Selection – Follow friction aggregate usage policies. If gravel is needed for use in a seal coat due to traffic level, it is to be crushed. If Wet Bottom Boiler Slag is used, it should be considered a “C” friction aggregate at best and should not be used on routes with over 1000 ADT.

Heavy Truck Turning and Down Grade Locations – The use of seal coats, micro-surfacing and slurry seals in areas of heavy truck turning movements is strongly cautioned due to the high potential for scuffing damage early in the surface life. If such a project is selected for treatment, it may be best to gap these areas and use other treatments at a later date.

Pavement Preparation – Pavement defects (bumps and cracks) need to be addressed prior to treatment. Proper pretreatment of these distresses can further extend the life of the preventive maintenance treatment several years.

Bump Grinding – Excessive bumps are not eliminated by any of the preventive maintenance treatments. Also, they can interfere with equipment used in some of the applications resulting in a rough ride. All of the preventive maintenance techniques have the same requirements for bump grinding.

Bumps 1/2 inch and greater, as determined with a 16-foot straightedge, shall be ground flush with adjacent pavement prior to treatment at no additional cost to the state. A roto-milling type machine may be used. Bump grinding resulting in loose material at cracks also needs to be sealed or an application of a bituminous surface treatment may be needed in the bump grinding area.

Crack Sealing – All active medium and high severity cracks (approximately 3/16 inch or wider) should be sealed prior to the micro-surfacing. Routing of the crack is not needed. The cracks should be blown clean with an air lance followed by crack sealing. Crack sealing shall be included in the contract as a separate pay item.

Micro-Surfacing and Slurry Seal projects should be sealed using a fiber-asphalt sealant as indicated in the special provisions. This bridges the opening and delays the reflective crack. Over-banding of the seal is recommended, but the thickness should be as thin as possible. Excessive thickness will interfere with the micro-surfacing spreader. Crack sealing should be completed 3 or more days prior to micro-surfacing. If an anti-tack agent is used it should be aggregate rather than paper products.

Bituminous Surface Treatment (Preventive Maintenance), Cape Seals and Half-SMART projects can be sealed with either the fiber-asphalt sealant or ASTM D6690, Type II (formerly ASTM D3405 - hot-poured joint sealer).

Temperature and Time of Year Restrictions – Several of the preventive maintenance treatments are dependent upon warm weather to ensure good performance. If the treatments are placed during cool weather, the slurry type mixtures will not “break” (cure) properly. Delays can occur

in opening to traffic. If opened to traffic prior to curing completely, the surface can be damaged. The following is a table showing time of year and temperature requirements for each treatment.

Treatment Type	Minimum Temperature	Time of Year for Placement
Bituminous Surface Treatment (Preventive Maintenance)*	> 13° C (55° F) in the shade	May 1 to August 31
Cape Seal	See criteria for other treatments	See criteria for other treatments
Half Smart Overlay	See criteria for HMA Overlays and Bituminous Surface Treatment (Preventive Maintenance)	See criteria for HMA Overlays and Bituminous Surface Treatment (Preventive Maintenance)
Micro-Surfacing	≥ 10° C (50° F) and rising with temperatures > 5° C (40° F) forecast for the next 24 hours	May 1 to October 15
Slurry Seal	≥ 10° C (50° F) and rising with temperatures > 5° C (40° F) forecast for the next 24 hours	May 1 to October 15

* Extended season requirements for temperature and weather forecasts are included in the special provision for this treatment.

Other Considerations:

Prior to contract work treatment, the shoulder area should be mowed. If there are areas where the shoulder has covered the edge of pavement, the material should be bladed back and swept prior to the contract work. These activities should not be part of the contract, but coordinated through operations.

Bituminous Surface Treatments (Preventive Maintenance):

For bituminous surface treatments (preventive maintenance, any needed pavement repairs should be completed using partial depth patches. Sections that require extensive full-depth repairs should be avoided. The pavement needs to be thoroughly cleaned and swept prior to treatment.

If the existing pavement has lane markings and there is a need to maintain traffic control with a temporary marking, temporary flexible raised pavement markers should be used. These markers are placed prior to treatment, following the existing pavement centerline/lane-to-lane markings. The markers only serve as temporary delineation until a permanent mark can be applied. As an alternative, the project work can include temporary paint striping. A permanent marking can be applied after 7 days of good drying weather.

The use of the Special Provision for Bituminous Surface Treatments (Preventive Maintenance) is recommended. Check Sheet #35 needs to be included in the contract. If temporary raised pavement markers are to going to be used on the project, the Special Provision for Temporary Flexible Raised Pavement Markers also needs to be included in the contract.

In bituminous surface treatments, the use of polymer-modified cationic emulsions promotes crack resistance and increased stone retention, as well as helps ensure quicker curing. Application rate versus aggregate type/size is critical. With smaller aggregates, the application rate of the emulsion becomes a more sensitive issue; fewer voids remain to be filled, and a

small error in the application rate of binder can result in bleeding or insufficient embedment. A larger-sized aggregate allows more binder to be applied with less risk of bleeding. Aggregates of large size (CA-16) are also better suited for areas marked by major cracks, given the need for thicker layers of binder under the chips on one hand, and the better load transfer capability of the larger aggregates on the other. Aggregates should not contain more than 2.5 percent passing the 75µm (#200) sieve.

Cape Seal:

For Cape Seals, any needed pavement repairs should be completed using partial depth patches. Sections that require extensive full-depth repairs should be avoided. The pavement needs to be thoroughly cleaned and swept prior to treatment.

The process is to apply a bituminous surface treatment then a micro-surfacing. The use of the Special Provision for Cape Seal is recommended.

Bituminous surface treatments provide excellent flexible protection against oxidation, cracking, and water permeation. The major problems with bituminous surface treatments are the loss of aggregate, damage to vehicles, streaking, bleeding, and a rough riding surface. Generally, they are not suitable for high-speed, high volume traffic. In addition, application during cold weather conditions can lead to premature failures.

Micro-surfacing restores surface profile, texture, and skid resistance with a durable mat that has no speed/traffic limitations, but it is relatively thin and brittle, and thus not adequately capable of preventing reflective cracking.

Both treatments are relatively very quick and cost-effective to construct and apply. With a cape seal, the two procedures have been combined to provide the benefits of both, while avoiding the disadvantages of each. The bituminous surface treatment provides an asphalt-rich membrane that seals cracks and prevents water intrusion into the substrate. The micro-surfacing mix over the bituminous surface treatment eliminates the problem of loose aggregate by holding the stones firmly in place, and provides a dense, durable surface having excellent skid resistance.

Construction is performed in a complimentary two-step surfacing operation involving the application of the two layers. There should be clear and effective communication between the Contractor constructing the bituminous surface treatment and the Contractor applying the micro-surfacing. It should also be noted that in a cape seal, the bituminous surface treatment and the covering micro-surfacing are eventually integrated and should not be treated as separate layers.

Diligence is necessary to prevent overspreading of aggregate in the bituminous surface treatment, excessive asphalt emulsion levels in either the bituminous surface treatment or the micro-surfacing, or excessive chip loss in the bituminous surface treatment before the micro-surfacing application. Excessively smooth or slick surfaces need to be addressed via grinding.

Generally, it is recommended that micro-surfacing be applied at a rate low enough to just create a thin layer over the bituminous surface treatment. Micro-surfacing should have sufficient fluidity to fill the voids between the individual aggregates. Filling the voids will cause the bituminous surface treatment and micro-surfacing to be well integrated and will prevent slippage of the micro-surfacing over the bituminous surface treatment.

Rates for the Bituminous Surface Treatment and Micro-Surfacing used in the cape seal are as follows.

High Distressed Pavements.

- Bituminous Surface Treatment Aggregate: CA-15 or CA-16, see the special provision for the application rate
- Micro-Surfacing Type II @ 22-25 lb/sq yd application rate

Medium Distressed Pavements.

- Bituminous Surface Treatment Aggregate as above or use FA-1 or FA-4, see the special provision for the application rate
- Micro-Surfacing Type II @ 22-25 lb/sq yd application rate

Micro-Surfacing:

Any needed pavement repairs should be completed using partial depth patches. Sections that require extensive full-depth repairs should be avoided. The pavement needs to be thoroughly cleaned and swept prior to treatment.

The designer will need to indicate the number of passes and whether or not there is rut filling on the plans. Usage of each type is as follows:

Rut Depth of Existing Pavement	Number of Passes	Aggregate Gradation	Application Rate Per Pass
< 0.35 inch	1	Type II	20 lb/sq yd
	2	Type II (Both Layers)	16 lb/sq yd
≥ 0.35 inch	1 + Rut filling	Type II (Surface Layer)	20 lb/sq yd
		Type III (Rut filling)*	As Needed

* Type III gradation is needed when the pavement is severely rutted. The larger gradation is necessary to help provide structure. However, specifying different gradations can result in some logistical problems (i.e. different mix designs, independent stockpiles, etc.).

Once the work is completed, the short term pavement markings should be placed. The markings can consist of water-based paint, tape, or flexible temporary raised pavement markers that are used for bituminous surface treatment. More experience in Illinois is needed before adopting such a practice. A permanent marking will need to be applied at a later date. Typically, 7 days of good drying weather are needed to completely cure out the new surface.

Slurry Seal:

This method is suitable for low speed or low volume roads. Any needed pavement repairs should be completed using partial depth patches. Sections that require extensive full-depth repairs should be avoided. The pavement needs to be thoroughly cleaned and swept prior to treatment. This treatment is very similar to micro-surfacing; however, it takes longer for this treatment to cure before opening to traffic. The level of ADT should be considered when deciding between a slurry seal and micro-surfacing.

Previously, Check Sheet #13 was used for this technique; however, it did not reflect the current practices. A special provision has been developed that includes updated information on equipment and application rate. This special provision shall be used in lieu of Check Sheet #13.